



PSMN022-30PL

N-channel 30 V 22 mΩ logic level MOSFET

Rev. 02 — 1 November 2010

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in TO220 package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

1.3 Applications

- DC-to-DC converters
- Motor control
- Load switching
- Server power supplies

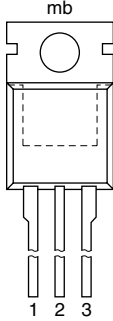
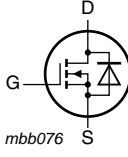
1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|--|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$ | - | - | 30 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see Figure 1 | - | - | 30 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ see Figure 2 | - | - | 41 | W |
| T_j | junction temperature | | -55 | - | 175 | °C |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 5\text{ A};$ $T_j = 25\text{ °C};$ see Figure 13 | - | 27 | 34 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 5\text{ A};$ $T_j = 25\text{ °C};$ see Figure 13 | - | 19 | 22 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 4.5\text{ V}; I_D = 5\text{ A};$ $V_{DS} = 15\text{ V};$ see Figure 14 ; | - | 1.4 | - | nC |
| $Q_{G(tot)}$ | total gate charge | see Figure 15 | - | 4.4 | - | nC |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 30\text{ A}; V_{sup} \leq 30\text{ V};$ $R_{GS} = 50\text{ Ω};$ unclamped | - | - | 7 | mJ |

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | G | gate |  |  |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|--------------|----------|--|---------|
| | Name | Description | Version |
| PSMN022-30PL | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |

4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|---|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$ | - | 30 | V |
| V_{DGR} | drain-gate voltage | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$ | - | 30 | V |
| V_{GS} | gate-source voltage | | -20 | 20 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$; see Figure 1 | - | 22 | A |
| | | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$; see Figure 1 | - | 30 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; see Figure 3 | - | 125 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | 41 | W |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | - | 30 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | - | 125 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 30\text{ A}; V_{sup} \leq 30\text{ V}; R_{GS} = 50\text{ }\Omega$; unclamped | - | 7 | mJ |

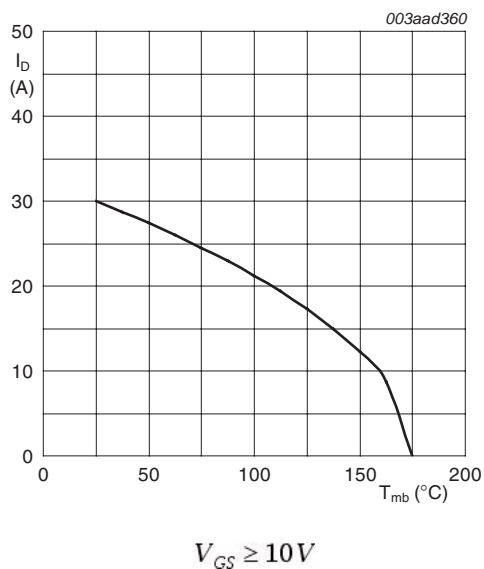


Fig 1. Continuous drain current as a function of mounting base temperature

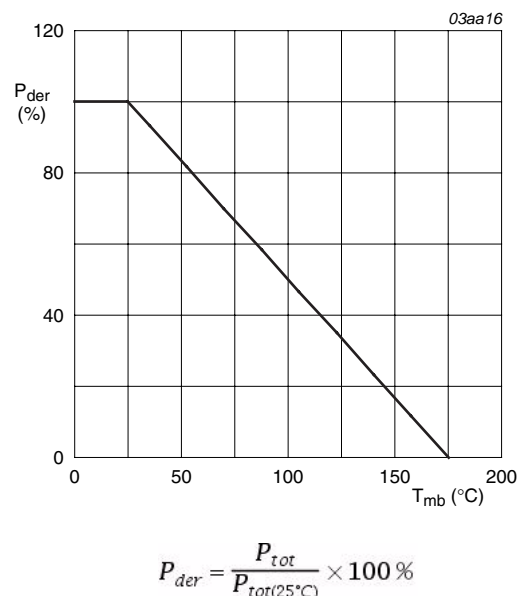
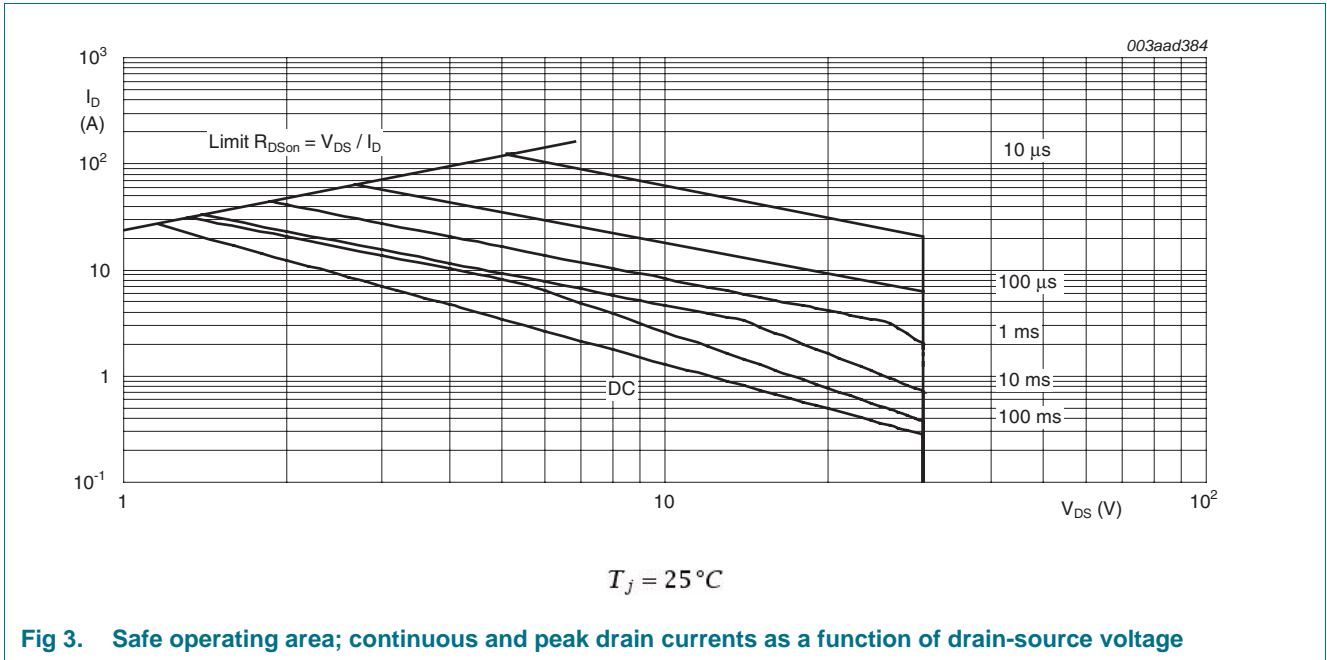


Fig 2. Normalized total power dissipation as a function of mounting base temperature



5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|------------------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see Figure 4 | - | 3.1 | 3.6 | K/W |

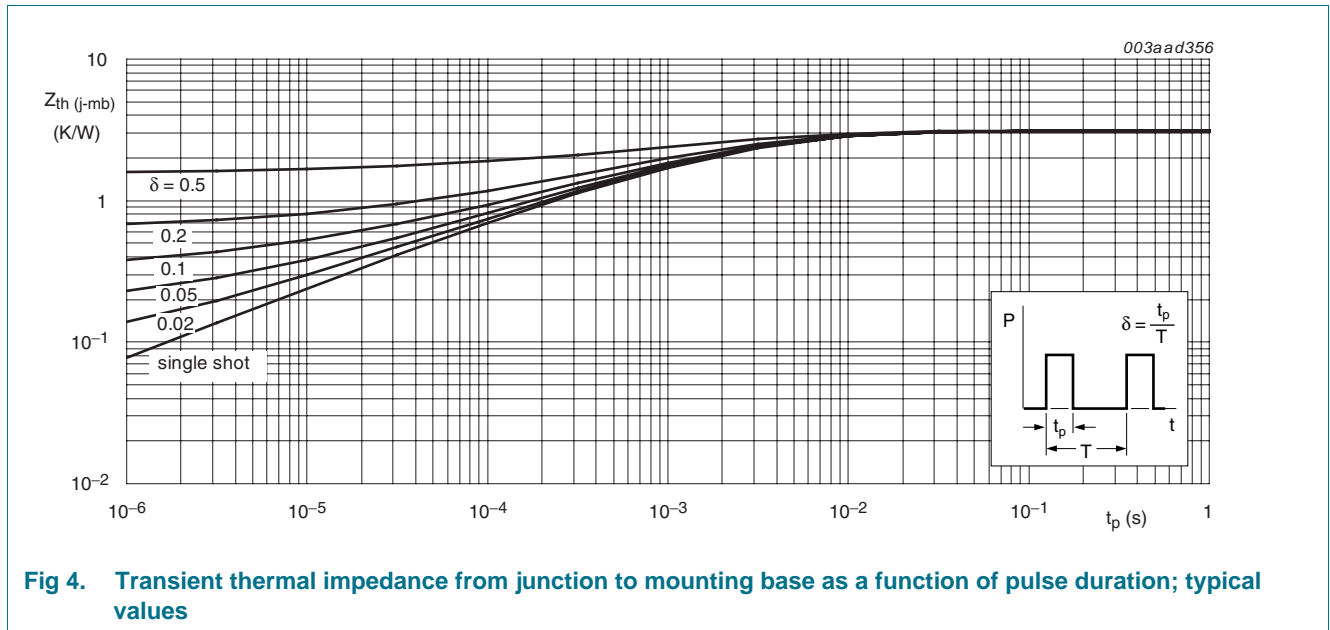


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

6. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|--|-----|-----|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 30 | - | - | V |
| | | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11 | 1.3 | 1.7 | 2.15 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 11 | 0.5 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 11 | - | - | 2.45 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.3 | 1 | μA |
| | | $V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$ | - | - | 50 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | 100 | nA |
| | | $V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5 \text{ V}; I_D = 5 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 12 | - | - | 64.6 | mΩ |
| | | $V_{GS} = 4.5 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 | - | 27 | 34 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 12 | - | 35 | 41.8 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see Figure 12 | - | - | 31 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 | - | 19 | 22 | mΩ |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | - | 2 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 5 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 ; see Figure 15 | - | 9 | - | nC |
| | | $I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$ | - | 8 | - | nC |
| | | $I_D = 5 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 14 ; see Figure 15 | - | 4.4 | - | nC |
| Q_{GS} | gate-source charge | see Figure 14 ; see Figure 15 | - | 1.6 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | $I_D = 5 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 14 | - | 0.8 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 0.8 | - | nC |
| Q_{GD} | gate-drain charge | $I_D = 5 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 14 ; see Figure 15 | - | 1.4 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $V_{DS} = 15 \text{ V};$ see Figure 14 ; see Figure 15 | - | 3 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 15 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ | - | 447 | - | pF |
| C_{oss} | output capacitance | $T_j = 25 \text{ }^\circ\text{C};$ see Figure 16 | - | 96 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 61 | - | pF |

Table 6. Characteristics ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|-----------------------|---|-----|-----|-----|------|
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 15\text{ V}; R_L = 1.5\ \Omega; V_{GS} = 4.5\text{ V};$ | - | 12 | - | ns |
| t_r | rise time | $R_{G(ext)} = 4.7\ \Omega$ | - | 29 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 17 | - | ns |
| t_f | fall time | | - | 7 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 5\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 17 | - | 0.7 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 5\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s};$ | - | 22 | - | ns |
| Q_r | recovered charge | $V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}$ | - | 10 | - | nC |

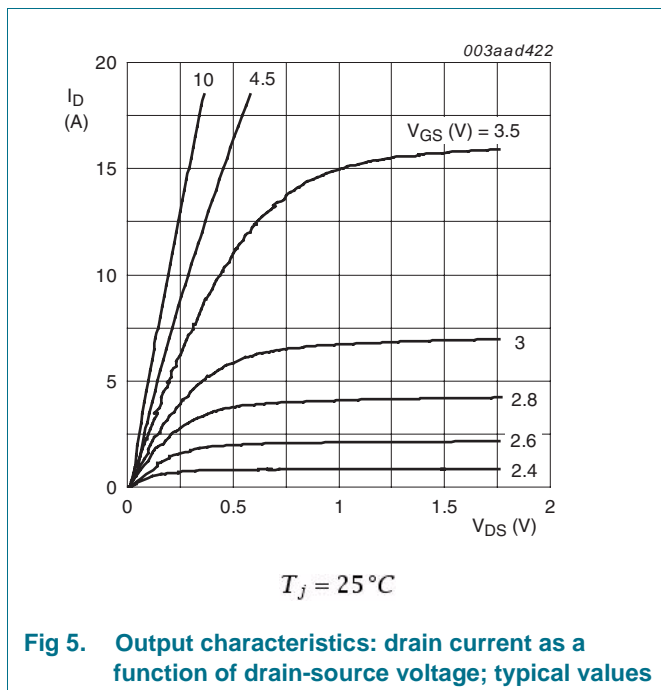


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

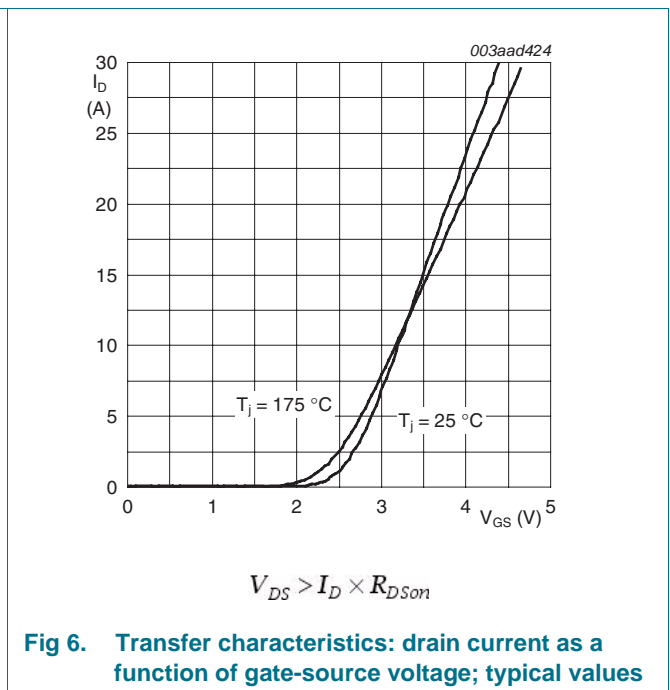
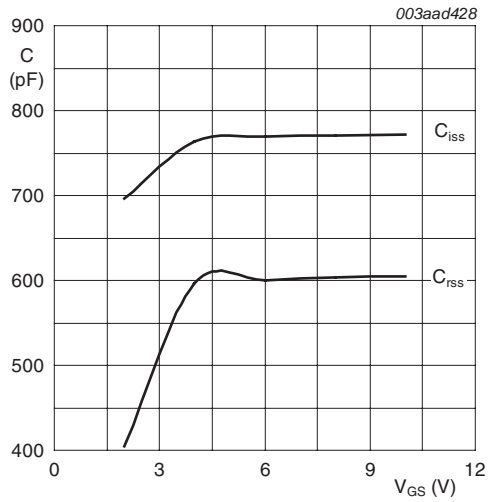
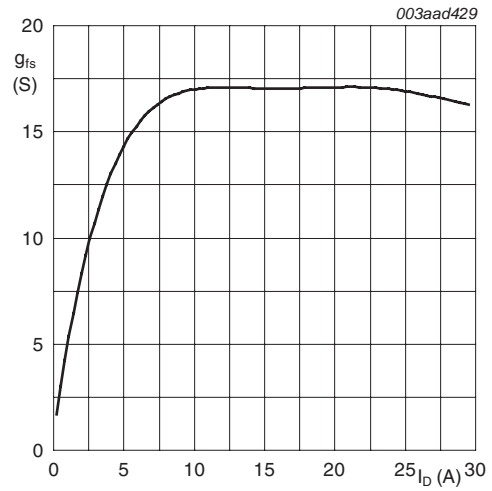


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values



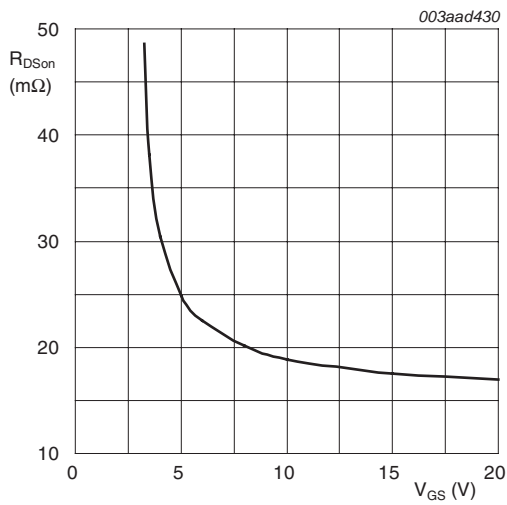
$V_{DS} = 0V; f = 1MHz$

Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



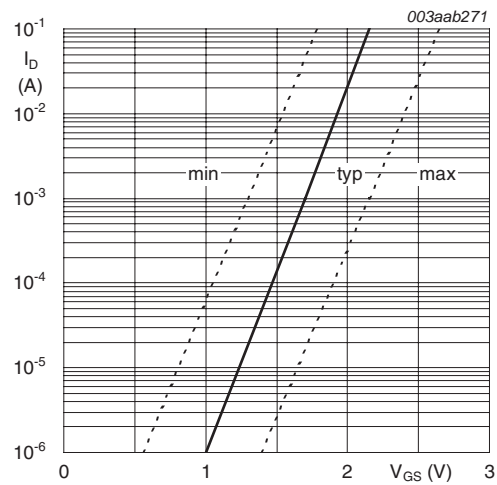
$T_j = 25^\circ C; V_{DS} = 10V$

Fig 8. Forward transconductance as a function of drain current; typical values



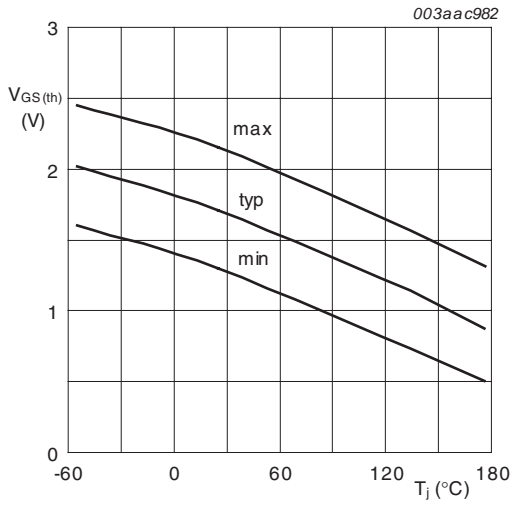
$T_j = 25^\circ C; I_D = 5A$

Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



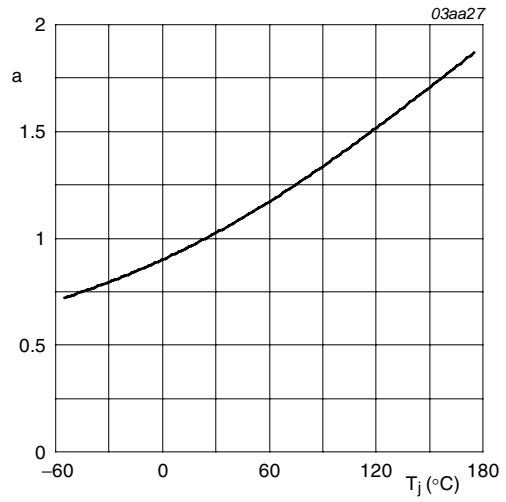
$T_j = 25^\circ C; V_{DS} = 5V$

Fig 10. Sub-threshold drain current as a function of gate-source voltage



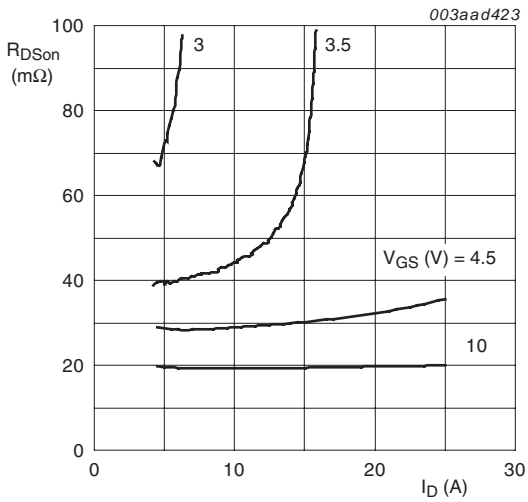
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

Fig 11. Gate-source threshold voltage as a function of junction temperature



$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



$T_j = 25^\circ\text{C}$

Fig 13. Drain-source on-state resistance as a function of drain current; typical values

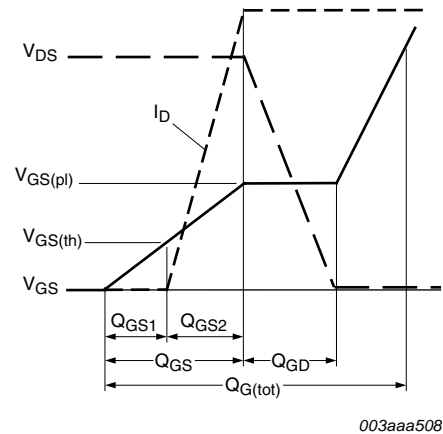
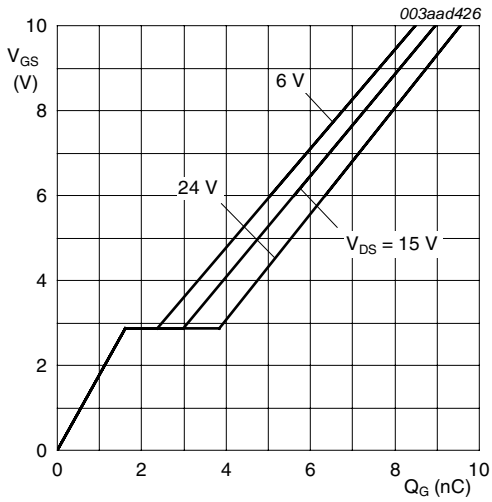
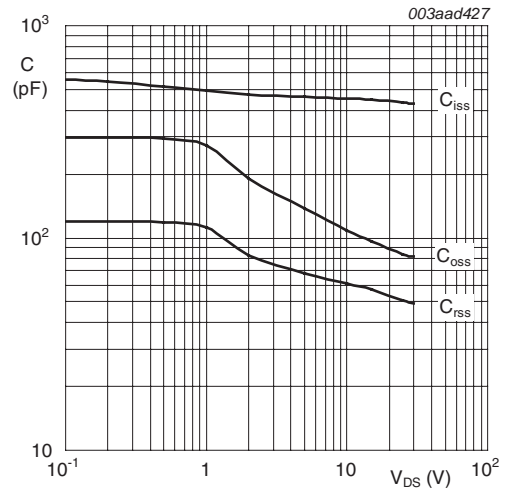


Fig 14. Gate charge waveform definitions



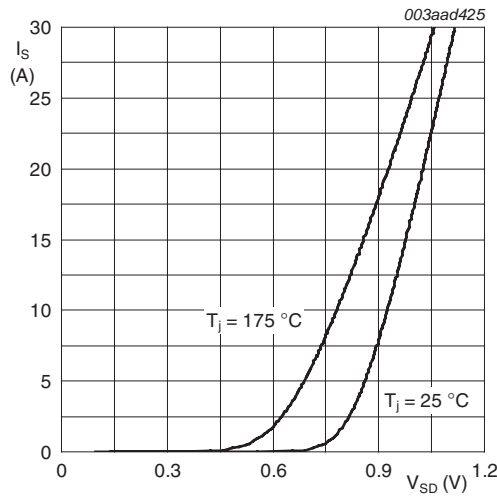
$T_j = 25\text{ }^\circ\text{C}; I_D = 5\text{ A}$

Fig 15. Gate-source voltage as a function of gate charge; typical values



$V_{GS} = 0\text{ V}; f = 1\text{ MHz}$

Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{GS} = 0\text{ V}$

Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

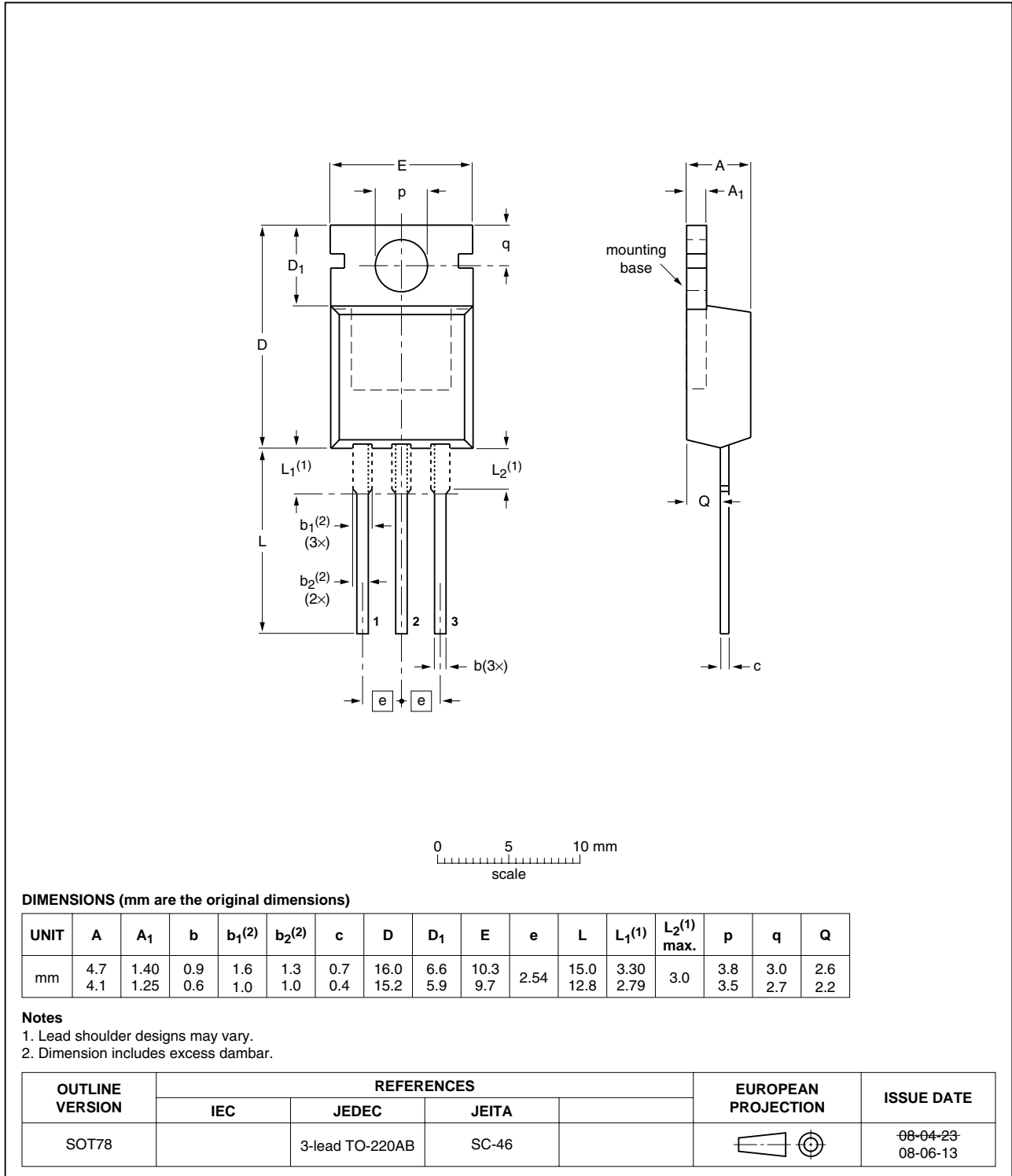


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|-------------------------------|--------------------|---------------|------------------|
| PSMN022-30PL v.2 | 20101101 | Product data sheet | - | PSMN022-30PL v.1 |
| Modifications: | • Various changes to content. | | | |
| PSMN022-30PL v.1 | 20101018 | Product data sheet | - | - |

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9.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
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[NTE2903](#) [NTE2941](#) [NTE2945](#) [NTE2946](#) [NTE2960](#) [NTE2967](#) [NTE2969](#) [NTE2976](#) [NTE455](#) [NTE6400A](#) [NTE2910](#) [NTE2916](#) [NTE2956](#)
[NTE2911](#) [US6M2GTR](#) [TK10A80W,S4X\(S](#) [SSM6P69NU,LF](#)